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HELIANTHUS INEXPECTATUS (ASTERACEAE), A TETRAPLOID PERENNIAL NEW SPECIES FROM SOUTHERN CALIFORNIA

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ABSTRACT

Helianthus inexpectatus is described as a new species from the Newhall Ranch of northern Los Angeles County, California. It is a tetraploid ($2n = 68$) perennial that is morphologically similar to—and intermediate in some characters between—the diploid *H. nuttallii* and the hexaploid *H. californicus*.

Key words: Asteraceae, *Helianthus*, *H. californicus*, *H. inexpectatus*, *H. nuttallii*, Newhall Ranch.

The discovery of a putatively extinct sunflower in Los Angeles County, California, in June 2002 was widely reported (Fausset and Chambers 2002). *Helianthus nuttallii* Torr. & A.Gray subsp. *parishii* (A.Gray) Heiser, dubbed the Los Angeles sunflower, had last been collected in 1937 and was noted by Keil (1993) as presumed extinct. News reports indicated that it had been found along the Santa Clara River in northern Los Angeles County on a portion of the Newhall Ranch slated for a large housing development.

Doubts were soon raised about the determination, with the possibility that the plants might actually represent a more widespread taxon, either *Helianthus nuttallii* subsp. *nuttallii* or *H. californicus* DC. (Parikh and Gale 2002). Porter and Fraga (2005) reported that the Newhall sunflower is tetraploid ($2n = 68$), whereas *H. nuttallii* subsp. *nuttallii* is diploid ($2n = 34$) and *H. californicus* is hexaploid ($2n = 102$) (Heiser et al. 1969). The chromosome number of *H. nuttallii* subsp. *parishii* is unknown. In a quantitative analysis of pollen characteristics, Porter and Fraga (2005) determined that in pollen diameter and other pollen characteristics the two subspecies of *H. nuttallii* are not significantly different. However there are some significant differences among the pollen grains of the Newhall sunflower, *H. californicus*, and *H. nuttallii*. In a complicated pattern of variation the Newhall sunflower's pollen is intermediate between that of *H. californicus* and *H. nuttallii*, e.g., in size. In some characters it shows affinity to *H. californicus* or *H. nuttallii*, whereas in others it differs significantly from both. Pollen size may accurately reflect ploidy differences between *H. californicus* and *H. nuttallii* (Heiser et al. 1969); thus the lack of any significant difference between the two subspecies of *H. nuttallii* suggests that both are diploid. The intermediate size of the Newhall sunflower's pollen is consistent with the reported ploidy levels of these plants. The implication is that the Newhall sunflower is not *H. nuttallii* subsp. *parishii*, which probably is indeed extinct.

Heiser et al. (1969) hypothesized that *H. nuttallii* was the source of one or two genomes of the hexaploid *H. californicus*. They considered *H. nuttallii* subsp. *parishii* to be the closest relative of *H. californicus* and noted the absence of any tetraploid perennial sunflower in western North America. The close similarity of the Newhall sunflower to both *H. nuttallii* subsp. *parishii* and *H. californicus* and its intermediate chromosome number suggest that the former might be an intermediate polyploid that links the two species (Porter and Fraga 2005). This is consistent with geographic distributions. Both *H. californicus* and *H. nuttallii* occur in southern California, and the natural range of the remaining species of *Helianthus* sect. *Divaricatus* is restricted to central or eastern North America (Heiser et al. 1969; Schilling 2003).

Timme et al. (2007) conducted a molecular phylogenetic analysis of *Helianthus* using the 18S–26S ribosomal DNA external transcribed spacer. Their results suggested that *Helianthus* sect. *Divaricatus* is polyphyletic. In that study the Newhall sunflower was sister to *H. nuttallii*. Timme et al. (2007) hypothesized that the Newhall sunflower is an autopolyploid derived from *H. nuttallii*, but indicated that additional markers would be needed to confirm this hypothesis. Molecular sequence data from ETS placed *H. californicus* in an entirely different clade than that of *H. nuttallii* and the Newhall sunflower. *Helianthus californicus* did not show any ETS types that would suggest that *H. nuttallii* or the Newhall sunflower had contributed to its genome.

The Newhall sunflower is morphologically very similar to both *H. californicus* and *H. nuttallii*, and because of plasticity within these species, it is difficult to separate from either species on a consistent basis. The phyllary width of the Newhall sunflower (2–3 mm) is more or less intermediate between that of *H. californicus* (usually 2.5–5 mm) and *H. nuttallii* (usually 1–1.5 mm), and the phyllary tips are often reflexed like those of *H. californicus*. Because of its different ploidy level, the Newhall sunflower is expected to be reproductively isolated from both *H. californicus* and *H. nuttallii*, and because of its geographical restriction, it is effectively isolated. We propose to recognize the Newhall sunflower as a cryptic species, to be included in the treatment of *Helianthus* in the forthcoming second edition of The Jepson Manual (B. G. Baldwin in prep.). This is consistent with the taxonomic concepts policy adopted in the Guide for Authors Contributing to the Second Edition of The Jepson Manual and to the Jepson Flora Project (Jepson Flora Project 2004), allowing the recognition of "taxa that do not differ in any

[3]The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

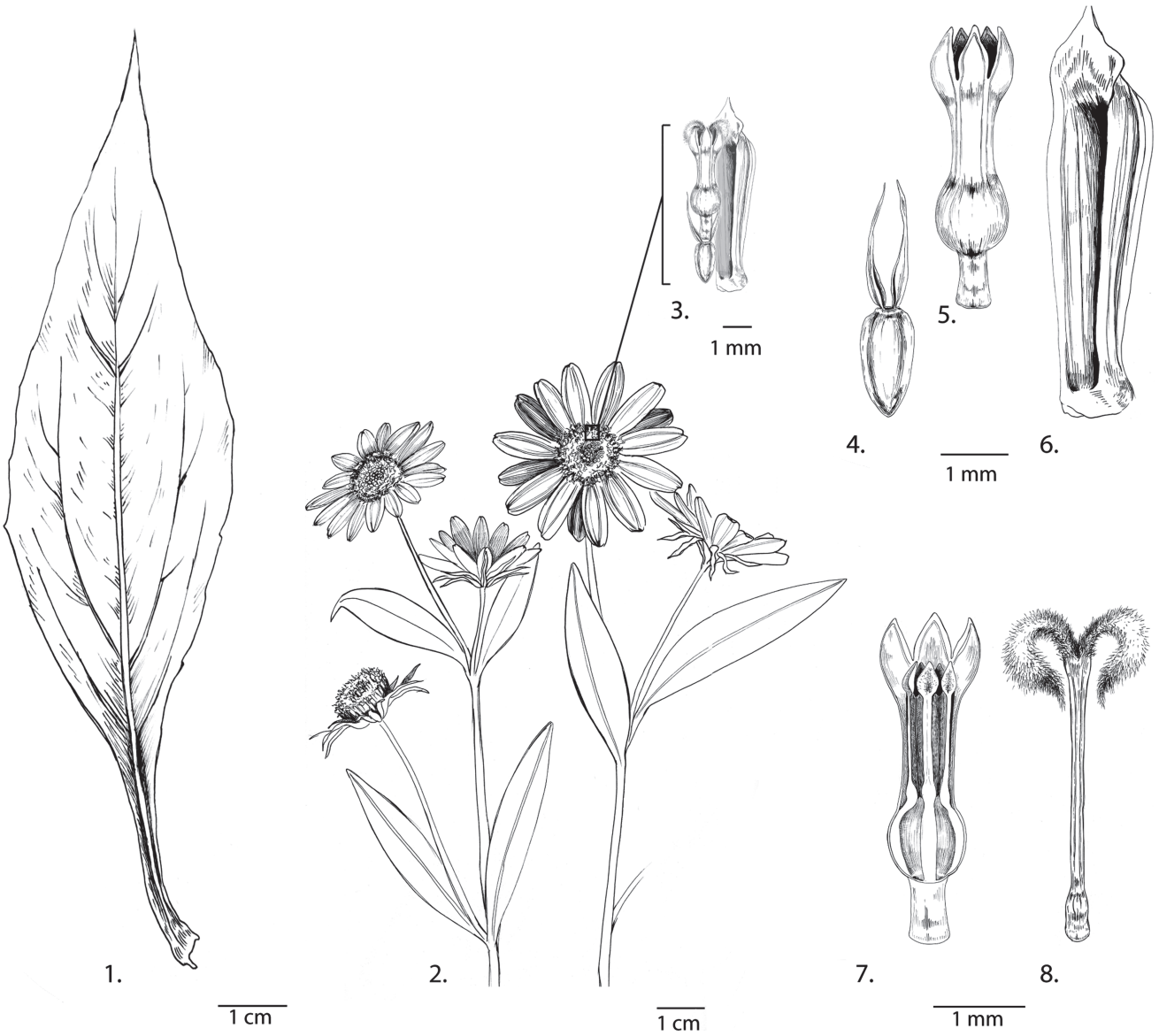

Fig. 1–8. *Helianthus inexpectatus* D.J.Keil & Elvin.—1. Proximal cauline leaf. 2. Branch tips with distal cauline leaves and flowering heads.—3. Inset, disk floret and subtending palea.—4. Fruit with pappus.—5. Disk floret corolla.—6. Palea.—7. Disk floret corolla, l.s., with anther column.—8. Style. Line drawings by Annette Felice.

readily determined morphological characteristics but that do differ consistently in geography and/or ecology.''

Helianthus inexpectatus D.J. Keil & Elvin, sp. nov.—TYPE: California. Los Angeles Co.: Western Transverse Range, Newhall Ranch, large natural spring at north foot of ''Airport Mesa,'' 0.75 mi SW of Castaic Junction, above confluence of Castaic Creek with Santa Clara River, near 34.42917°N, 118.6144°W, 305 m, wet, mucky area at spring, surrounded by willow forest, Sep 2002, *A. Parikh and N. Gale s.n.* (holotype UCR, isotype RSA).

Heliantho californico et *H. nuttallii* subsp. *parishii* affinis, sed chromosomatum numero tetraploideo (2*n* = 68) et phyllariis generaliter 2–3 mm latis apicibus saepe reflexis differt.

Perennial herb 15–50 dm from short rhizome with thick, woody roots. Stems many from base, erect or arching, glabrous or nearly so. Leaves alternate or opposite, well-distributed along stem, distal smaller; petioles 0–3 cm long, narrowly winged; blades 10–20 cm long, proximal ones (Fig. 1) +/− elliptic, 4–6.5 cm wide, apices obtuse to acute, mid and distal ones (Fig. 2) +/− lanceolate, narrower, entire, bases cuneate, apices acute or acuminate, margins entire or shallowly dentate, both faces strigose to scabrous or short-hispid, abaxially dotted with sessile resin glands. Heads 1–7+ in open clusters at tips of main stems or branches (Fig. 2); peduncles 3–15 cm long, distally villous to hispid; involucre body 1–2.5 cm in diameter; phyllaries 10–25 mm long, 2–3 mm wide, often much exceeding the disk, linear or narrowly lanceolate, appressed bases veiny, ciliate, abiaxally glabrous or sparsely hirtellous, apices lanceolate to long-acuminate, ascending to spreading or reflexed, margins ciliate, faces +/− glabrous to hirtellous; paleae (Fig. 3, 6)

7–8 mm long, +/− entire or shallowly 3-lobed, middle lobe ovate, obtuse or acute, hirtellous, lateral lobes inconspicuous, tooth-like. Ray florets 12–21; laminae 2–3 cm long, golden yellow. Disk florets (Fig. 5, 7, 8) many, corollas 5–6 mm long, lobes yellow; anthers dark brown; style branches included or only slightly exserted. Achenes (Fig. 4) 3–3.8 mm long; pappus scales 2, narrowly lanceolate, 3–4 mm long. $2n = 68$.

Etymology.—The specific epithet refers to the unexpected discovery of this new species, its unexpected status as a tetraploid, and its unexpected apparent lack of a close relationship to *H. californicus*.

Paratypes.—California. Newhall Ranch, large natural spring at north foot of "Airport Mesa," 0.75 mi SW of Castaic Junction NE end of Santa Susana Mtns., 34.42917°N, 118.61528°W, 305 m, 25 Jun 2002 (in vegetative condition), *A. C. Sanders 25257 with M. Elvin* (IRVC, RSA, UCR); same location, 17 Jul 2002 (in vegetative condition), *M. A. Elvin 2099* (OBI); same locality, 12 Aug 2002 (in bud), *M. A. Elvin 2124 with Julie Vanderwier* (UC); same location, 28 Aug 2002 (in bud), *A. C. Sanders 25604 with M. A. Elvin* (UCR); same location and date (in bud), *A. C. Sanders 25605 with M. A. Elvin* (UCR); same location and date (in bud), *A. C. Sanders 25606 with M. A. Elvin* (UCR); same location and date (in flower), *A. C. Sanders 25607 with M. A. Elvin* (UCR); same location, 5 Sep 2002 (in flower), *M. A. Elvin 2140 with Tricia Wotipka* (OBI, UC).

Notes.—*Helianthus inexpectatus* is known only from the type locality along the Santa Clara River near Newhall in Los Angeles Co., California, based on field surveys by the second author and others (Parikh and Gale 2004; DUDEK 2007, 2008) and searches of herbaria collections (IRVC, JEPS, OBI, RSA/POM, SD, UC, UCR). It flowers from August to October. *Helianthus inexpectatus* grows in a shallow seep (approximately one acre in size) that appears to be fed by at least three springs at the base of a ridge (DUDEK 2007; Elvin pers. obs. 2002). The seep occurs on a terrace on the south side of the Santa Clara River approximately 1.3 km upstream from its junction with Castaic Creek. The spring and seep system, which we refer to as "Castaic Springs," is not marked on USGS topographic maps, but has been referred to as "Middle Canyon Spring" in environmental documents regarding development plans by Newhall Land and Farming Company.

The seep is perennially mesic and has water flowing through it year round, even in extreme drought years (Elvin pers. obs. 2002). Associated species in the seep include *Baccharis douglasii* DC., *Berula erecta* (Huds.) Coville, *Juncus* L. spp., *Mimulus guttatus* DC., *Salix lasiolepis* Benth., *Schoenoplectus* (Rchb.) Palla spp., *Urtica dioica* L. subsp. *holosericea* (Nutt.) Thorne, and *Vitis girdiana* Munson. A recently described spring snail, *Pyrgulopsis castaicensis* Hershler and Liu, is also known only from this seep (Hershler and Liu 2010).

The seep is directly adjacent to lands slated for development as part of a master-planned community that would include an estimated 20,000+ homes and a bridge that is proposed to be installed within 100 m (USACOE and CDFG 2009; Hershler and Liu 2010) of the seep. Potential effects to *Helianthus inexpectatus* from the proposed bridge include shading from the bridge, disruption of the hydrological regime of the springs and seep from installation of its pilings. Potential effects due to the proposed development include hydrological alteration (i.e., water quality and quantity), habitat degradation, invasive species, trampling by humans, and edge effects (Alberts et al. 1993; DUDEK 2008).

Because of its remarkable geographical restriction, population size (fewer that ten individuals known), and threats, the Newhall sunflower appears to meet the criteria necessary for listing under both State and Federal Endangered Species Acts.

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